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18

CENTERS FOR DISEASE CONTROL

MALARIA

SURVEILLANCE

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES • Public Health Service

PREFACE

This report summarizes information received from state health departments, medical departments of the Armed Forces, and other sources. It is intended primarily for the use of those with responsibility for disease control activities. Anyone desiring to quote this report should contact the original investigator for confirmation and interpretation.

Contributions to the Surveillance Report are most welcome. Please address them to:

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SUGGGESTED CITATION

Centers for Disease Control: Malaria Surveillance Annual Summary 1984
Issued September 1985

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I. SUMMARY

During 1984, 1,016 cases of malaria diagnosed in the United States were reported to the Centers for Disease Control. This compares with 803 cases reported in 1983, an increase of 26.5%. A total of 360 cases with onset in 1984 were reported in U.S. civilians, more than in any year since the early 1950's. A total of 632 cases were reported in foreigners.

Plasmodium vivax was the parasite identified in 60% of the 1,014 cases, and P. falciparum was identified in 26% of the cases. P. malariae and P. ovale were reported in 5% and 2% of cases, respectively. The species was not determined in the remaining cases. Only 1 of the 1,016 cases involved a person who acquired the infection in the United States. This was due to congenital transmission. Ten deaths attributed to malaria were reported for 1984, compared with 3 such deaths in 1983.

II. TERMINOLOGY

The terminology used in this report is derived from the recommendations of the World Health Organization (WHO)(1). The definitions of the following terms are included for reference purposes:

A. Autochthonous

1. Indigenous--malaria acquired by mosquito transmission in an area where malaria is a regular occurrence.

2. Introduced--malaria acquired by mosquito transmission from an imported case in an area where malaria is not a regular occurrence.

B. Imported

Malaria acquired outside a specific area (the United States, Puerto Rico, and Guam in this report).

C. Induced

Malaria acquired through artificial means, i.e., blood transfusion, common syringes, or malariotherapy.

D. Relapsing

Renewed manifestation (of clinical symptoms and/or parasitemia) of malarial infection, separated from previous manifestations of the same infection by an interval greater than any interval due to the normal periodicity of the paroxysms.

E. Cryptic

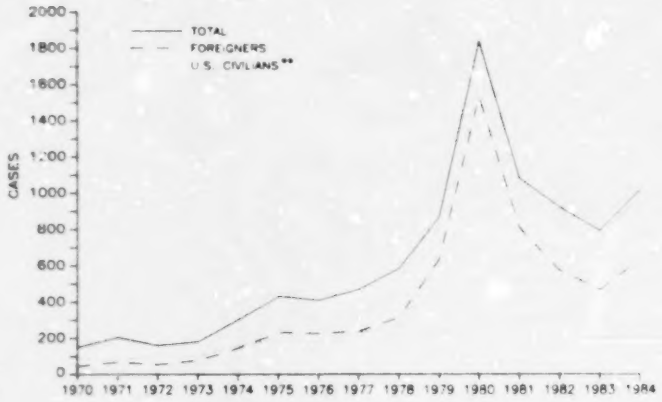
An isolated case of malaria not associated with secondary cases as determined by appropriate epidemiologic investigation.

III. GENERAL SURVEILLANCE

A total of 1,016 cases* with onset of illness in 1984 in the United States were reported to the Division of Parasitic Diseases, Center for Infectious Diseases, Centers for Disease Control (CDC); this represents a 27% increase compared with the 803 cases reported for 1983. Only 24 of the cases occurred in U.S. military personnel. Civilian cases have accounted for the majority of cases each year since 1973 (Table 1).

Malaria in foreign civilians accounted for 632 (62.2%) of all reported cases (Table 1), representing a 35% increase in the number of such cases in this group compared with 1983. The number of malaria cases in U.S. civilians increased by 11% from 1983 (Figure 1).

FIG. 1 CASES OF MALARIA IN U.S. CIVILIANS AND FOREIGNERS, UNITED STATES, 1970–1984*



*INCLUDES PUERTO RICO, THE VIRGIN ISLANDS, AND GUAM
**INCLUDES 8 CASES ACQUIRED IN THE UNITED STATES

Table 1 All Primary Malaria Cases in Civilians and Military Personnel with Onset of Illness in the United States, 1966-1983*

Year	Military	U.S. Civilians	Foreign Civilians	Unknown	Total
1966	621	89	32	22	764
1967	2,699	92	51	15	2,857
1968	2,567	82	49	0	2,698
1969	3,914	90	47	11	4,062
1970	4,096	90	44	17	4,247
1971	2,975	79	69	57	3,180
1972	454	106	54	0	614
1973	41	103	78	0	222
1974	21	158	144	0	323
1975	17	199	232	0	448
1976	5	178	227	5	415
1977	11	233	237	0	481
1978	31	270	315	0	616
1979	11	229	634	3	877
1980	26	303	1,534	1	1,864
1981	21	273	809	0	1,103
1982	8	348	574	0	930
1983	10	325	468	0	803
1984	24	360**	632	0	1,016

*Includes Puerto Rico, the Virgin Islands, and Guam.
**Includes 1 case acquired in the United States.

*A "case" is defined as: 1) an individual's first attack of malaria in the United States, regardless of whether or not he/she had experienced previous attacks of malaria while outside the country, and 2) the presence of a positive peripheral blood smear examined in the local or state health department laboratory. Blood smears from doubtful cases were referred to the National Malaria Repository, CDC, for confirmation of the diagnosis. A subsequent attack in the same person caused by a different Plasmodium species is counted as an additional case. A repeated attack in the same person in this country caused by the same species is not considered to be an additional case.

The number of malaria cases in U.S. civilians increased from 325 cases in 1983 to 360 cases in 1984, a 10.8% increase. Malaria in foreign civilians increased from 468 reported cases in 1983 to 632 cases in 1984, a 35.0% increase.

Only 1 of the 1,016 cases involved a person who acquired the infection in the United States. This was due to congenital transmission.

The Plasmodium species could be determined in 951 of the 1,016 cases (93.6%). In 1984, P. vivax was identified in 60% and P. falciparum in 26% of the infected individuals (Table 2).

Table 2 All Malaria Cases by Plasmodium Species, United States, 1983 & 1984

Species	1983 Total	1983 Percent	1984 Total	1984 Percent
P. vivax	451	56.1	612	60.2
P. falciparum	237	29.5	261	25.7
P. malariae	36	4.5	53	5.2
P. ovale	20	2.5	20	2.0
Mixed	4	0.5	5	0.5
Undetermined	55	6.8	65	6.4
TOTAL	803	100.0	1016	100.0

The countries of origin of the 1,016 cases are listed in Table 3.

The geographic distribution of the malaria cases within the United States is shown in Figure 2 by the State in which the patient first developed clinical symptoms of malaria.

Fig.2 GEOGRAPHIC DISTRIBUTION OF MALARIA CASES WITH ONSET IN THE UNITED STATES, 1984

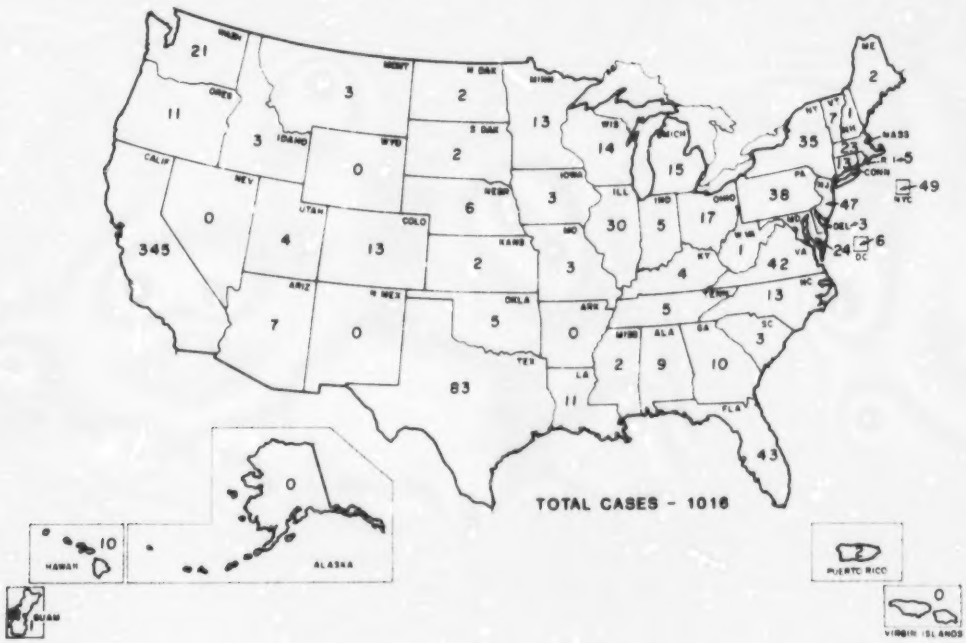


TABLE 3. Malaria Cases by Distribution of *Plasmodium* Species and Area of Acquisition, United States, 1984*

Area of Acquisition	*vivax*	*falciparum*	*malariae*	*ovale*	mixed	unknown	Total
AFRICA	60	196	18	16	2	27	319
Africa, East†	2	3	0	0	0	0	5
Africa, West†	1	8	0	0	0	1	10
Africa, Unspecified†	3	5	1	1	1	3	14
Angola	0	0	1	0	0	0	1
Benin	0	1	1	0	0	0	2
Cameroon	0	2	0	0	0	2	4
Central Afr Rep	0	2	0	0	0	0	2
Chad	0	0	0	0	0	1	1
Congo	0	1	0	0	0	0	1
Egypt	1	0	0	0	0	0	1
Ethiopia	8	2	0	1	0	0	11
Gabon	0	2	0	0	0	0	2
Ghana	4	12	3	0	0	3	22
Guinea	0	1	0	0	0	1	2
Ivory Coast	1	2	0	0	0	0	3
Kenya	10	31	4	2	0	1	48
Liberia	1	7	0	3	0	0	11
Malagasy Republic	1	1	0	0	0	0	2
Malawi	0	1	0	0	0	0	1
Mozambique	0	1	0	0	0	0	1
Nigeria	8	77	5	4	0	9	103
Rwanda	1	0	0	0	0	0	1
Sierra Leone	3	7	0	4	0	2	16
South Africa	1	1	0	0	0	0	2
Sudan	13	2	0	0	0	1	16
Tanzania	1	5	0	0	1	0	8
Togo	0	3	0	0	0	0	3
Uganda	1	3	0	1	0	0	5
Upper Volta	0	2	1	0	0	1	4
Zaire	0	5	1	0	0	1	7
Zambia	0	2	0	0	0	1	3
Zimbabwe	0	6	1	0	0	0	7
ASIA	285	29	24	3	0	27	368
Asia, South East†	35	3	2	0	0	4	44
Afghanistan	4	0	0	0	0	1	5
Bangladesh	0	0	1	0	0	0	1
India	183	20	17	1	0	16	237
Indonesia	8	0	0	0	0	1	9
Kampuchea	1	1	0	0	0	0	2
Pakistan	29	1	2	0	0	3	35
Philippines	11	2	1	0	0	1	15
Sri Lanka	2	0	0	0	0	0	2
Thailand	2	1	0	0	0	0	3
Turkey	0	0	1	0	0	0	1
Yemen	0	0	0	1	0	0	1
Vietnam	10	1	0	1	0	1	13
CENTRAL AMERICA AND CARIBBEAN	177	30	7	0	2	8	224
Caribbean, Unspec†	0	0	0	0	0	1	1
Central Amer Unspec†	3	1	1	0	0	0	5
Belize	4	1	0	0	0	0	5
El Salvador	127	3	5	0	1	4	140
Guatemala	10	1	0	0	0	1	12
Haiti	0	19	0	0	0	0	19
Honduras	26	4	1	0	1	1	33
Nicaragua	7	0	0	0	0	0	7
Panama	0	1	0	0	0	1	2
NORTH AMERICA	62	0	2	1	1	1	67
Mexico	62	0	2	0	1	1	66
United States	0	0	0	1	0	0	1
SOUTH AMERICA	8	3	1	0	0	1	13
America, South†	0	0	1	0	0	0	1
Brazil	1	1	0	0	0	0	2
Colombia	3	2	0	0	0	0	5
Ecuador	1	0	0	0	0	1	2
Guyana	1	0	0	0	0	0	1
Peru	2	0	0	0	0	0	2
OCEANIA	16	1	1	0	0	0	18
Pacific, South†	1	0	0	0	0	0	1
New Guinea	14	1	1	0	0	0	16
Solomon Islands	1	0	0	0	0	0	1
UNKNOWN	4	2	0	0	0	1	7
TOTAL	612	261	53	20	5	65	1016

*Includes Puerto Rico, Virgin Islands and Guam

†Country unspecified

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The interval between the date of arrival in the United States and the date of onset of illness was known for 642 of the imported cases for which the infecting Plasmodium species was identified also. Clinical malaria developed within 1 month after arrival in 85.6% of the patients with P. falciparum malaria and in 33.1% of the patients with P. vivax infections (Table 4). Only 15 (2.3%) of the 642 patients became ill 1 year or more after their arrival in the United States.

Table 4 Imported Malaria Cases by Interval between Date of Entry and Onset of Illness and by Plasmodium Species, United States, 1984

Interval (in months)	PLASMODIUM SPECIES									
	vivax	(%)	falciparum	(%)	malariae	(%)	ovale	(%)	Total	(%)
< 1	133	(33.1)	166	(85.6)	13	(39.4)	5	(38.5)	317	(49.4)
1-2	84	(20.9)	18	(9.3)	7	(21.2)	1	(7.7)	110	(17.1)
3-5	83	(20.6)	4	(2.1)	6	(18.2)	4	(30.8)	97	(15.1)
6-11	91	(22.6)	3	(1.5)	7	(21.2)	2	(15.4)	103	(16.0)
≥12	11	(2.7)	3	(1.5)	0	(0.0)	1	(7.7)	15	(2.3)
TOTAL	402	(100.0)	194	(100.0)	33	(100.0)	13	(100.0)	642	(100.0)

Ten fatal cases due to malaria were reported in 1984 compared with 3 such cases in 1983. These cases are discussed in Section VII.

IV. MALARIA IN MILITARY PERSONNEL

Twenty-four cases of malaria were reported in U.S. military personnel in 1983. The Army accounted for 10 cases, the Navy for 2, the Marine Corps for 8 cases and for 4 cases the branch of service is not known.

V. IMPORTED MALARIA IN CIVILIANS

The number of malaria cases in civilians imported from Mexico and El Salvador doubled from 100 cases in 1983 to 206 in 1984.

Malaria in U.S. citizens accounted for 359 (36.2%) of the 991 imported cases in civilians, whereas 632 (63.8%) of the cases occurred in citizens of other countries (Table 5). Of the 359 imported cases in U.S. civilians, 170 (51.7%) were acquired in Africa and 83 (24.6%) were acquired in Asia.

Imported malaria in U.S. civilians who had been infected in Africa increased from 102 cases in 1981 to 129 cases in 1982, 164 cases in 1983, and 170 cases in 1984. Of the 170 infections imported from Africa, 109 (64%) were caused by P. falciparum, and 60 (55%) of these had been acquired in Kenya or Nigeria.

Table 5 Imported Cases in Civilians, by Area in Which Malaria was Acquired, United States, 1984

Area of Acquisition	U.S. Civilians		Foreigners		Total	
	Cases	Percent	Cases	Percent	Cases	Percent
Africa	170	51.7	146	23.1	316	31.9
Asia	83	24.6	276	43.7	359	36.2
Central America	34	9.1	161	25.5	195	19.7
Caribbean	13	3.8	7	1.1	20	2.0
Mexico	29	3.8	37	5.9	66	6.7
South America	10	3.2	2	0.3	12	1.2
Oceania	17	3.8	0	0.0	17	1.7
Unknown	3	0.0	3	0.5	6	0.6
TOTAL	359	100.0	632	100.0	991	100.0

Of the 632 imported cases in foreign civilians in 1984, 276 (44%) were acquired in Asia. Of all such cases in foreign civilians in 1984, 171 (27%) were acquired in India, compared with 107 cases acquired in that country in 1983.

The principal changes in several categories of imported cases in U.S. civilians from the corresponding 1983 data are shown in Table 6.

Table 6 Imported Malaria Cases in U.S. Civilians, by Category, United States, 1983-1984

Category	1983		1984	
	Cases	Percent	Cases	Percent
Tourist	140	44.3	122	33.8
Business Representative	42	13.2	49	13.7
Government Employee	6	1.9	7	2.0
Missionary	34	10.7	45	12.6
Peace Corps	9	2.8	10	2.8
Seamen/Aircrew	3	0.9	5	1.4
Teacher/Student	15	4.7	21	5.9
Other	25	7.9	40	11.1
Unknown	43	13.6	60	16.8
TOTAL	317	100.0	359	100.0

VI. MALARIA ACQUIRED IN THE UNITED STATES

One case of congenital malaria with onset of illness in the United States during 1984 was reported; the infection was caused by P. ovale. The mother was a native of Nigeria.

Case 1--On April 4, 1984, a 19-day-old male infant in San Francisco, California, developed fever. P. ovale parasites were identified in a peripheral blood smear. The patient was treated with chloroquine and had an uneventful recovery. The 44-year-old Nigerian mother had arrived in the United States 36 hours before the delivery. P. ovale parasites were also found in a blood smear of the mother, and she was treated with chloroquine. She had had an episode suggestive of malaria in January 1984 for which she had obtained medication locally.

(Reported by Larry A. Waites, M.D., San Francisco, Nancy Mayer, B.A., San Francisco Department of Public Health, and Robert A. Murray, Dr.P.H., California Department of Health Services.)

VII. MALARIA DEATHS IN THE UNITED STATES

Ten deaths in 1984 due to malaria were reported in the United States. All but 2 occurred in U.S. citizens who had acquired malaria abroad.

Case 1--A 57-year-old male travel agent was admitted to a Ohio hospital on March 22, 1984, with a history of chills, fever, nausea, vomiting, diarrhea and myalgia which began on March 14, 1984. Upon admission, the patient was in a state of circulatory shock, icteric, tachypneic, and he had cyanotic extremities with petechiae and purpura. The patient developed renal failure and slipped into a coma. Examination of a peripheral blood smear revealed a 12% P. falciparum parasitemia. Although an infusion of packed red cells was given and 800 mgm. quinine was administered through a nasogastric tube, the patient died 2 hours after admission.
The patient had traveled to Kenya from January 6-19, 1984, and to Rio de Janeiro, Brazil, from February 16-26, 1984. He reportedly had taken weekly chloroquine prophylaxis from January 3 to February 28, 1984.

(Reported by Sylvan L. Weinberg, M.D., Dayton, Ohio, and Ellen Peterson, Ohio State Department of Health.)

Case 2--On February 13, 1984, a 39-year-old Canadian man was admitted to a Laredo, Texas, hospital with a 3-week history of chills, fever and headache. P. malariae parasites were identified in a blood smear and the

patient was treated with chloroquine. The patient died 3 days after admission. The cause of death was reported as cardiac arrest. Before his arrival in the United States, the man had traveled for 4 months in Mexico, Guatemala and El Salvador, but he had not taken malaria chemoprophylaxis. The precise date of entry could not be determined.

(Reported by G. Villareal, M.D., Laredo, Texas, and Jeffery P. Taylor, M.P.H., Bureau of Epidemiology, Texas State Health Department.)

Case 3--A 3-year-old boy came to the United States with his mother and 2 siblings from his native Tanzania. While in Dar-es-Salaam he had episodes of fever for which he was treated with chloroquine. Five days after arrival in this country he developed malaise, vomiting and rigors. He was treated with amoxycillin for suspected otitis media. Three days later he was admitted to a hospital with febrile seizures. On admission, a 15% P. falciparum parasitemia was found in a peripheral blood smear. He developed renal failure, adult respiratory distress syndrome (ARDS), and died shortly after i.v. quinine therapy was started. No autopsy could be performed.
After this patient had been admitted, his 2 siblings also had episodes of fever and came to the hospital. Both were found to have P. falciparum parasitemia. One of these, a 5-year-old boy, was initially treated with chloroquine, but the parasitemia increased to 12% after 2 days. He was then given pyrimethamine and sulfadoxine, to which he responded. He was discharged on the 4th hospital day. The parasitemia in the other sibling, a 2-year-old girl, responded to chloroquine therapy.

(Reported by J.A. Tilelli, M.D., Children's Hospital, St. Paul, Minnesota, and the Minnesota Department of Health.)

Case 4--A 32-year-old California woman developed periodic episodes of fever, chills and rigor with onset on July 1, 1984. On July 5 she sought medical attention and was admitted to a hospital the next day. Peripheral blood smears revealed a heavy parasitemia with P. falciparum parasites. She was treated with quinine, pyrimethamine and sulfadiazine. The patient developed hemolysis, acute renal failure, and went into shock. The parasitemia cleared after 3 days, but the patient died on July 15, 1984.
She had visited Togo and other West African countries for 2 weeks and had returned to the United States on June 20. She had not taken malaria chemoprophylaxis.

(Reported by Jorge Delgadillo, M.D., Pomona, California; Timothy G. Stephenson, M.P.H., Alexander F. Taylor, M.P.H., George R. Petterson, M.D., M.P.H., San Bernardino County Department of Public Health; Ronald R. Roberto, M.D., M.P.H., and Robert A. Murray, Dr.P.H., California State Department of Health Services.)

Case 5--A 27-year-old merchant seaman was admitted on July 23, 1984, to a Florida hospital with a 5-day history of influenza-like symptoms, including chills. Upon admission he was found to have a 60% P. falciparum parasitemia. The patient was given chloroquine, followed by i.v. quinidine. The parasitemia decreased to less than 5% after 16 hours. However, the patient became hypotensive, developed seizures, and died.

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He had traveled by ship to Dakar, Abidjan and Kinshasha, where he left to return by plane to the United States on July 17, 1984. He had not taken malaria chemoprophylaxis.
The county health department notified all crewmembers to have a blood smear examined for malaria parasites and to take a 6-week prophylactic course of chloroquine.

(Reported by L. Jadeja, M.D., Jacksonville, Florida, R. Stockton, Duval County Health Department, and the Florida State Department of Health.)

Case 6--A 48-year-old woman was admitted to a Long Island, New York, hospital on September 1, 1984, with a history of high fevers with chills and abdominal pain. Over the next few days, the patient developed progressive lethargy. At that point, P. falciparum parasites were noted on a routine peripheral blood smear. About 25% of the erythrocytes were parasitized. The patient was treated with i.v. quinine for 10 days, with return of her mental status to baseline and clearing of her parasitemia. However, the patient's fevers persisted. The patient then developed ARDS and required intubation with ventilatory support. Her condition stabilized for 2 weeks, although she still required ventilatory support, but then deteriorated. Open-lung biopsy showed interstitial pneumonitis and fibrosis, which were believed to be due to malarial infection. Although the patient also received steroids, her pulmonary status continued to deteriorate, and she died on October 13, 1984, approximately 5 weeks after admission.
The woman had been in Senegal and the Gambia for 2 weeks and had returned 3 weeks before she was admitted to the hospital. No malaria prophylactic drug had been used.

(Reported by Carol Singer, M.D., New Hyde Park, New York, and the New York Department of Health.)

Case 7--A 25-year-old male Christian Scientist and journalist went to Kenya on November 23, 1984, for a journalism assignment. He used no malaria prophylactic medication. On December 16, 1984, the patient returned to Boston ill. Two days later, he was admitted to a Benevolent Home for care but received no specific therapy. The journalist died on December 21, 1984; at autopsy, a blood smear showed lysed erythrocytes with malaria pigment. Tissue preparations from throughout the body showed intracapillary erythrocytes parasitized with P. falciparum. The spleen was markedly enlarged and the brain was involved.

(Reported by Leonard Atkins, M.D., Medical Examiner, Eastern Massachusetts Regional Office, Boston, Massachussetts.)

Case 8--On August 17, 1984, a 15-year-old Virginia boy came to the emergency room (ER) of a Virginia hospital with a 1-week history of chills, nausea, and vomiting and loose, watery, brown stools. He was confused, but able to walk into the ER. He had no blood pressure and was noted to have a thready pulse. The patient was icteric and had poor perfusion, tachycardia, Kussmaul breathing and petechiae.

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He was resuscitated with fluids and transferred to a hospital in Washington, D.C. A peripheral bloodsmear showed P. falciparum parasites. He was given quinine sulfate and antibiotics. The patient was noted to have poor respiratory effort, but to be alert. He developed renal failure requiring hemodialysis on August 20. Grossly bloody material was obtained from the peritoneal cavity; 1.8 liters of this material were evacuated. Liver and spleen scans showed no spleen, and on August 21 a splenectomy was performed for a ruptured spleen. He was unresponsive to verbal and pain stimuli. Pupils were non-reactive but corneal reactions were present. He developed ARDS, bradycardia, hypotension, arrythmias and died on August 25, 1984. The autopsy showed extensive hemorrhage and malarial pigment deposits in the Kupffer cells of the liver.
The patient had returned 1 week before onset of symptoms from a trip to Kenya. It is unknown whether he had used malaria prophylaxis.

(Reported by P. Holbrook, M.D., and R. Chandra, M.D., District of Columbia.)

Case 9--On August 6, 1984, a 51-year-old missionary was admitted to a Seattle, Washington, hospital with a 2-day history of fever, headache, malaise, and diarrhea. He became delirious and on admission he was comatose. The patient had had 2 previous febrile episodes: one 7 weeks before admission resolved spontaneously, and a second episode 3 weeks before admission resolved after taking 3 tablets of amodiaquine. Examination of a peripheral blood smear revealed 8% of the red blood cells to be parasitized with P. falciparum parasites. Intravenous quinidine and doxycycline cleared the parasitemia within 48 hours. During this period the patient developed aspiration pneumonitis and a clinical picture consistent with ARDS. Numerous pulmonary complications ensued which caused the patient's death 3 weeks after admission.
The patient had been a missionary in Africa for 23 years. He returned from Nigeria 7 weeks before the onset of his illness. Six months before his admission he had discontinued routine malaria chemoprophylaxis.

(Reported by Jan M. Agost, M.D., and Elaine C. Jong, M.D., Department of Medicine, University of Washington, Seattle, Washington, and the Washington Department of Health.)

Case 10--A 45-year-old California man developed low-grade fever, headache, malaise, myalgia, vomiting and diarrhea on February 18, 1984. A diagnosis of influenza-like syndrome was made during a medical visit 4 days later, when he had also developed cough, chills, high fever and delirium. On February 23 he collapsed and was pronounced dead on arrival at the hospital.

Autopsy revealed a malaria infection due to P. falciparum on the basis of microscopic examination of tissues. Malarial trophozoites were identified in many red blood cells, and malarial pigment was observed in others.
The patient had traveled to Zimbabwe between January 10 and February 6, 1984. He neither sought medical advice regarding travel precautions nor did he take chemoprophylaxis during the trip.

(Reported by Timothy G. Stephenson, M.P.H., Alexander F. Taylor, M.P.H., George R. Petterson, M.D., San Bernardino County Department of Public Health; Antoinette D. Mahoney, M.D., San Bernardino; Ronald R. Roberto, M.D., M.P.H., and Robert A. Murray, Dr.P.H., California State Department of Health Services.)

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VIII. PREVENTION OF MALARIA

Guidelines for the prevention of malaria in travelers have been published in "Health Information for International Travel 1985," dated September 1985. This CDC publication also provides information about countries and, where applicable, areas within each country, where malaria risk exists. In addition, areas in the world where chloroquine-resistant strains of *P. falciparum* are known to exist are listed. Revised recommendations for malaria prophylaxis for travelers to areas with chloroquine-resistant *P. falciparum* have also been published in the April 12, 1985, issue of the *Morbidity and Mortality Weekly Report* (*MMWR*), vol. 34, no. 14, pp. 185-190.

IX. MICROSCOPIC DIAGNOSIS OF MALARIA

Early diagnosis of malaria requires a high level of clinical suspicion and, in particular, a comprehensive travel history taken from every patient with a fever of unknown origin. Once malaria is suspected, a Giemsa-stained smear of peripheral blood should be examined for the presence of parasites. Since the accuracy of diagnosis is dependent on the quality of the blood film, the following guide is offered for the proper preparation of thick and thin blood smears.

1. Manufacturers' "pre-cleaned" slides are not considered clean enough for use in malaria diagnosis. Before use, wash these slides in mild detergent, rinse them thoroughly in warm running water, then in distilled water, and dip them in ethyl alcohol (90%-95%). Then, wipe slides dry with a lintless cloth or tissue for immediate use or store them in 95% alcohol until needed.
2. Clean the patient's finger with alcohol and wipe the finger dry with a clean cloth or gauze.
3. After puncturing the finger with the blood lancet, allow a large globule of blood to form.
4. Place the cleaned surface of the slide against the drop of blood and, with a quick circular motion, make a film the size of a dime in the middle third of 1 end of the slide. Ordinary newsprint should be barely legible through such a wet drop (Figure 3). (Excessive mixing or stirring with a second slide leads to distortion of blood cells and parasites.)
5. Wipe the finger dry and gently squeeze a small drop of blood from the puncture, placing it at the edge of the middle third of the same slide (Figure 4).
6. Apply a clean "spreader" slide to the edge of the small drop at a 45° angle and allow the blood to extend about two-thirds of the slide width; then, keeping even contact, push the spreader forward along the slide. This will produce an even layer of red blood cells with a "feathering" at the lower edge (Figure 5).
7. While the thick blood film dries (minimum of 6 hours at room temperature)**, keep the film horizontal and protected from dust and insects.
8. Label the slide in the upper part of the thin film with the date and the name or initials of the patient as illustrated (Figure 5).

**If a rapid diagnosis is desired, make the thick and thin films on separate slides. The thin film can be air dried, fixed with methyl alcohol and stained immediately. If no parasites are found on the thin film, examine the thick film for organisms not detected on the thin preparation.

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Fig. 3

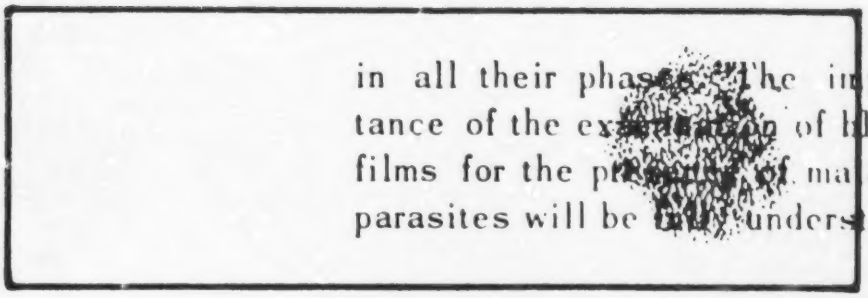

in all their phases. The importance of the examination of blood films for the presence of malaria parasites will be fully understood

Fig. 4

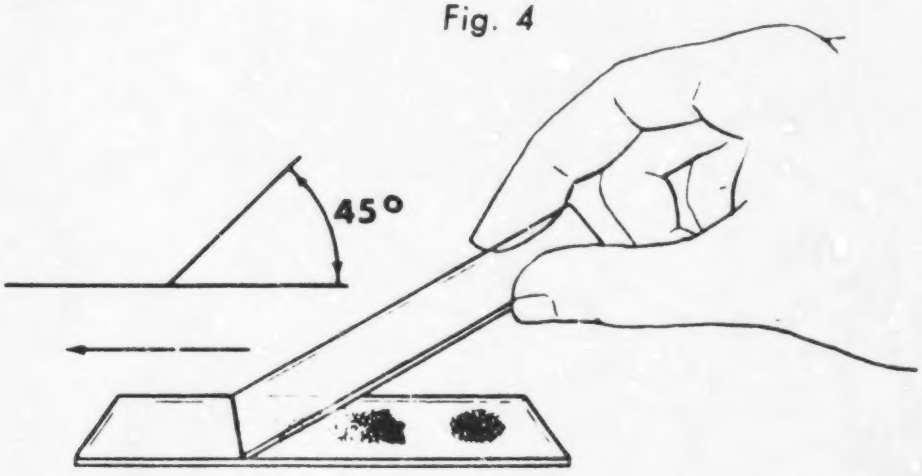
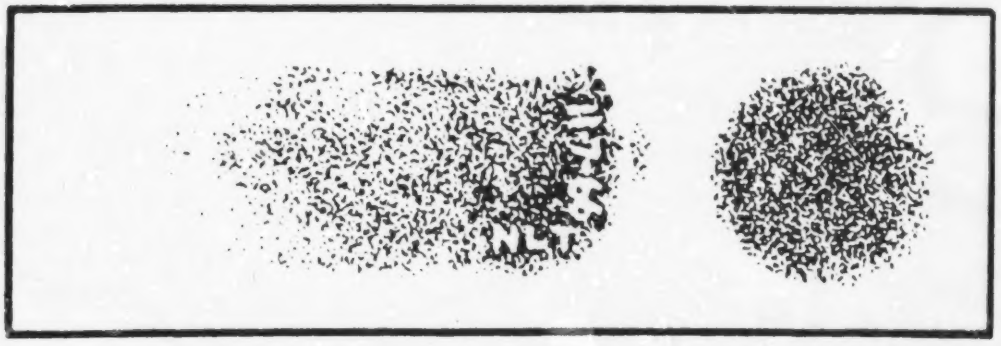


Fig. 5



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1. World Health Organization. Terminology of malaria and of malaria eradication, 1963, World Health Organization, Geneva, p. 32.

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